

# Two new species of *Sminthopsis* Thomas (Dasyuridae: Marsupialia) from northern Australia, *S. butleri* and *S. douglasi*

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## ABSTRACT

Two new species of *Sminthopsis* are described; *Sminthopsis butleri* n. sp. from northern Western Australia and Cape York, and *Sminthopsis douglasi* n. sp. from northern central Queensland, in the watershed areas of major rivers draining north into the Gulf of Carpentaria. The distribution of *S. butleri* is probably a relict of a formerly (or perhaps extant but unknown) wider range. It is most closely related to *Sminthopsis macroura* (Gould). *S. douglasi* is a very rare and vulnerable species, and may be endangered. It is the second largest species of Dunnart and is closely related to *Sminthopsis virginiae* (Tarracon). Its large size may be the result of character displacement, a reaction to the sympatric, smaller, but morphologically similar *S. macroura* (Gould).

## INTRODUCTION

In the course of preparing a revision of the genus *Sminthopsis*, it became evident that two distinct, but unnamed species were represented in existing collections. Specimens of one of these (*Sminthopsis butleri*) were originally collected by Mr A. S. Meek in 1898, from Cape York, Queensland, and more recently by Mr W. H. Butler, from the Kimberley region of Western Australia. The other species (*Sminthopsis douglasi*) is based on specimens collected from north central Queensland by Mr M. Browne in the 1930s.

Having mistakenly assumed that my descriptions of these species would be published earlier than their general reviews, I made the results of my studies on *Sminthopsis* available to several colleagues. This inadvertently resulted in the publication as *nomina nuda* of the two names established in the present paper (e.g. Kirsch 1977).

Terminology of molar and cranial morphology follows Archer (1976a and b); that of tooth number, Archer (1978); and that of pedal morphology, Archer (1977). Selected aspects of this terminology are shown in Figs. 1-2. Measurements

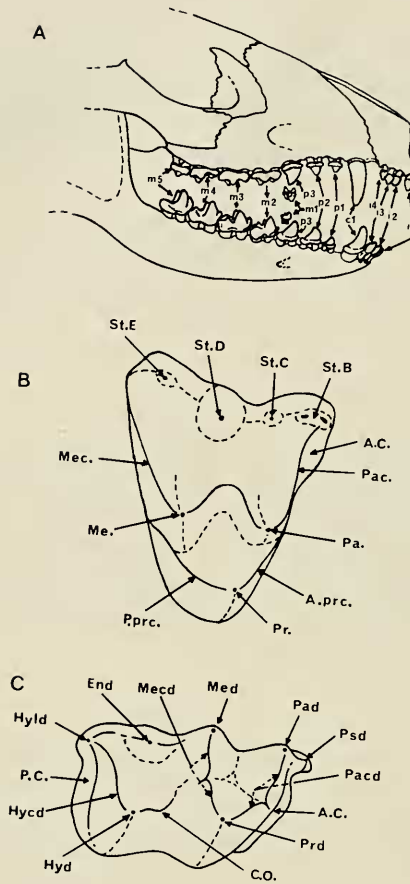


FIG. 1. Terminology of the dentition and molar crowns.

- A. Right lateral view of the rostrum and dentary of a *Sminthopsis (S. virginiae)*.
- B. Right upper fourth molar (RM<sup>4</sup>) of *S. douglasi*.
- C. Right lower fourth molar (RM<sup>3</sup>) of *S. douglasi*.

Abbreviations as follows: A, i = incisor, c = canine, p = premolar, and m = molar; B, A.C. = anterior cingulum, A. prc. = anterior protocrista, Me. = metacone, Mec. = metacrista (more specifically postmetacrista), Pa. = paracone, Pac. = paracrista (more specifically preparacrista), Pr. = protocone, P. prc. = preprotocrista, St. B — E = stylar cusps B to E; C, A.C. = anterior cingulid (or precingulid), C.O. = cristid obliqua, End = entoconid, Hycd = hypocristid, Hyd = hypoconid, Hyld = hypoconulid, Mecd = metacristid, Med = metaconid, Pacd = paracristid, Pad = paraconid, P.C. = posterior cingulum, Prd = protoconid, Psd = parastylid.

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are the same as those defined in the revision of *Antechinomys* (Archer 1977). Abbreviations of institutions are as follows: BM, British Museum (Natural History); B, Butler collection in the Western Australian Museum; J or JM, Queensland Museum; WAM, Western Australian Museum.

The thirteen species of *Sminthopsis* (placed in two sugenera) recognized in the revisionary work in preparation are as follows: *S. murina* (Waterhouse including as junior synonyms *albipes* Waterhouse, *fuliginosa* Gould, and *tatei* Troughton; *S. ooldea* Troughton; *S. leucopus* (Gray), including the junior synonym *ferruginifrons* Gould, *mittelli* Krefft, and *leucogenys* Higgins and Petterd; *S. virginiae* (Troughton), including the junior synonyms *nitela* Collett, *rufigenis* Thomas, *lumboltzi* Iredale and Troughton, and *rona* Tate and Archbold; *S. macroura* (Gould), including the junior synonyms *froggatti* Ramsay, *larapinta* Spencer, *stalker* Thomas, and *monticola* Troughton; *S. hirtipes* Thomas; *S. granulipes* Troughton; *S. psammophila* Spencer; *S. longicaudata* Spencer; *S. crassicaudata* (Gould), including the junior synonyms *centralis* Thomas, and *ferruginea* Finlayson; *S. butleri* Archer (the present work); *S. douglasi* Archer (the present work); *S. (Antechinomys) laniger* (Gould).

## SYSTEMATICS

### *Sminthopsis butleri* n. sp.

TYPE SPECIMEN: Holotype: WAM M7158, skull and carcase in alcohol, adult female, collected by Mr W. H. Butler, 14 December 1965.

TYPE LOCALITY: Kalumburu (Lat. 14°15'S, Long. 126°40'E, northern Western Australia (Fig. 5).

DIAGNOSIS: A medium-sized species of *Sminthopsis* (Fig. 4A and B) that differs from *S. murina*, *S. leucopus* and *S. ooldea* in having a vague head-stripe, a conspicuously enlarged and unstriated apical granule on each interdigital pad, and long premaxillary vacuities. It differs from *S. psammophila* in being smaller, in lacking a crest on the tail, and in having non-granular terminal pads on the digits. It differs from *S. macroura* and *S. douglasi* in having a thin tail, in lacking entoconids on M<sub>2</sub> to M<sub>4</sub>, and in having relatively short premaxillary vacuities. It differs from *S. virginiae* in being smaller, lacking rufous cheeks, lacking entoconids on M<sub>2</sub> to M<sub>4</sub>, and in having relatively short premaxillary vacuities. It differs from *S. crassicaudata* in having a thin tail, a lack of entoconids on M<sub>2</sub> to M<sub>4</sub>, and an enlarged apical granule on the interdigital pads. It differs from *S. longicaudata* in having a tail that is less than twice the nose-vent length, a relatively small alisphenoid tympanic wing, a lack of elongate striated apical granules on the interdigital pads, and a lack of striations on the terminal pads of the digits. It differs from *S. hirtipes* in having a thin tail, relatively long premaxillary vacuities, non-granular terminal pads of the digits, a relatively small alisphenoid tympanic wing, and in lacking hair on

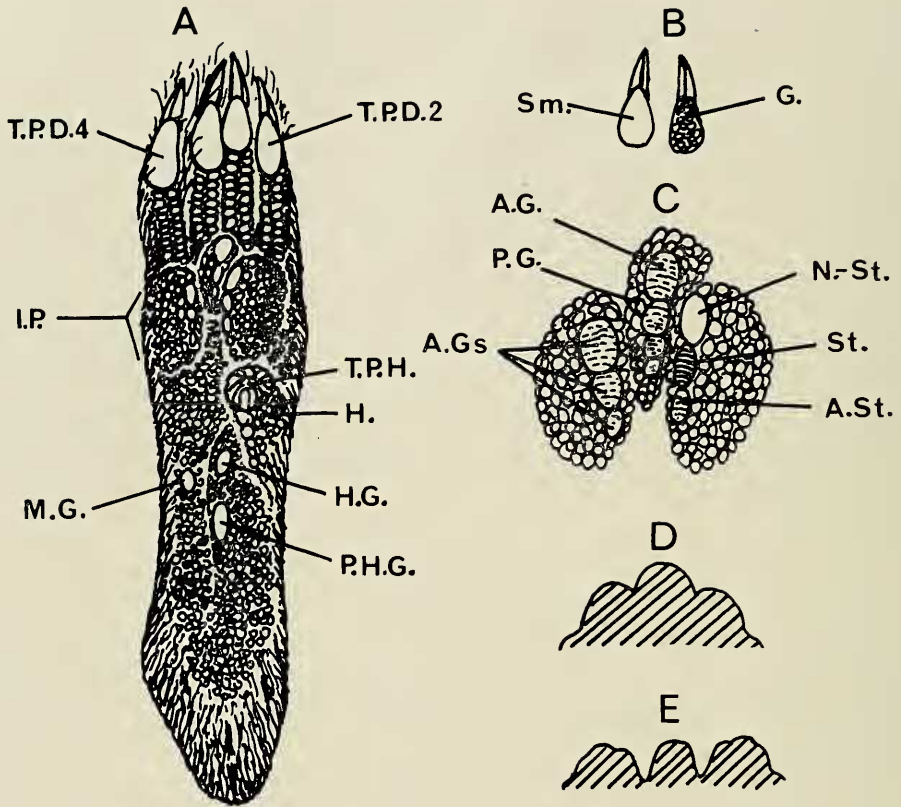


FIG. 2. Terminology for the hind foot of species of *Sminthopsis*. Some features are not present in *S. douglasi* or *S. butleri* (e.g. the post-hallucal granule) but are mentioned in regard to differentiating these from other species in the genus. A, right hind foot, plantar view. B, Terminal digital pads and claws to illustrate alternative conditions of the skin surface. C, the interdigital pads to illustrate terminology and alternative conditions (shown on interdigital pad 1 in this figure) of apical pad surfaces. D, transverse section through the interdigital pads of a species in which the pads are fused towards their top. E, the same as D, but in a species whose pads are unfused or separate to their bases. Abbreviations for A-C are as follows: A.G. = apical granule; A.Gs = row of apical granules containing (in the case illustrated) three apical granules; A. St. = apparently striated appearance of apical granule surface; G. = granular condition of skin surface; H = hallux (the first digit); H.G. = hallucal granule; I.P. = interdigital pads (three); M.G. = metatarsal granule; N-St. = Non-striated (or smooth) appearance of apical granule surface; P.G. = proximal granules (granules adjacent to apical granules); P.H.G. = post-hallucal granule; Sm. = smooth (non-granular) appearance of skin surface; St. = striated surface of apical granule; T.P.D. 2-4 = terminal pads of digits two to four; T.P.H. = terminal pad of hallux.



the interdigital pads of the hind-feet. It differs from *S. granulipes* in having a thin tail, non-granular terminal pads on the digits, an enlarged apical granule on each hairless interdigital pad, a relatively crowded premolar row, and wider molars.

**DESCRIPTION:** Tail: The tail is invariably thin and about equal in length to the nose-vent length.

**Hind foot:** The hind foot has three interdigital pads that are united at their common base. Each interdigital pad has a medium row of granules each of which become progressively larger towards the distal end of each pad. Each row culminates in a large apical granule. Of five alcohol-preserved specimens, only one (B1937) exhibits fusion of an apical granule with the proximal granules (on the left and right fourth interdigital pads, the apical granule is fused with a proximal granule and there is also an imperfect fusion involving apical and proximal granules of the left and right second interdigital pads). On some interdigital pads (e.g. the left and right fourth of WAM M7158 and B1941), the apical rows are not as long and do not involve as many granules as in other specimens (e.g. the third of B1943 and WAM M7158). The presence of the hallucal granule is variable, being clearly differentiated for example in B1943, B1941 and B1937 but virtually absent on the right foot of B1937 and both feet of WAM M7158. No granules exhibit actual ridges on the surface of the pads but some apical and proximal granules (e.g. B1941) have apparent striae. The hallux does not extend forward far enough to touch the second interdigital pad.

**Nose:** The nose has a medial groove which does not extend to the top of the naked rhinarium. A narrow, hairless, ventrolateral rim is present.

**Nipple number:** Specimen WAM M7158 has eight distinct nipples.

**Pelage:** A relatively dark mid-dorsal head-stripe extends from an area about midway between the nose and the anterior edge of the eye to between the ears, behind which it merges with the color of the back. A dark ring occurs around each eye but does not form part of the lateral face stripe. The very light colour of the belly extends onto the flanks between the fore and hind legs and along the base of the cheeks beneath the ear. Ridgway (1912) colours for a dry skin (WAM M7156) and an alcohol carcase (WAM M7158) are as follows: Above the eye, vinaceous-Buff to Avellaneous (M7156) or Pale Ochraceous-Buff (mixed) (M7158); middle of the back, Buffy brown to Drab Mouse Gray (former as tips of hairs) (M7156) or Blackish Brown (M7158); flank, Pale Ochraceous salmon to Vinaceous-Buff (M7156) or Light Buff (M7158); belly, white to Ivory yellow (M7156) or paler than Massicot yellow (M7158).

**Dentition:** The  $I^1$  is the tallest upper incisor and is set off from  $I^2$  by a diastema. Upper incisor crown heights increase posteriorly from  $I^2$  to  $I^4$ . The  $I^4$  has a small (B1995) or absent (WAM M7156) posterior lobe. A diastema occurs between  $I^4$  and  $C^1$ . The  $C^1$  has posterobuccal and posterolingual cingula, a small posterior cin-

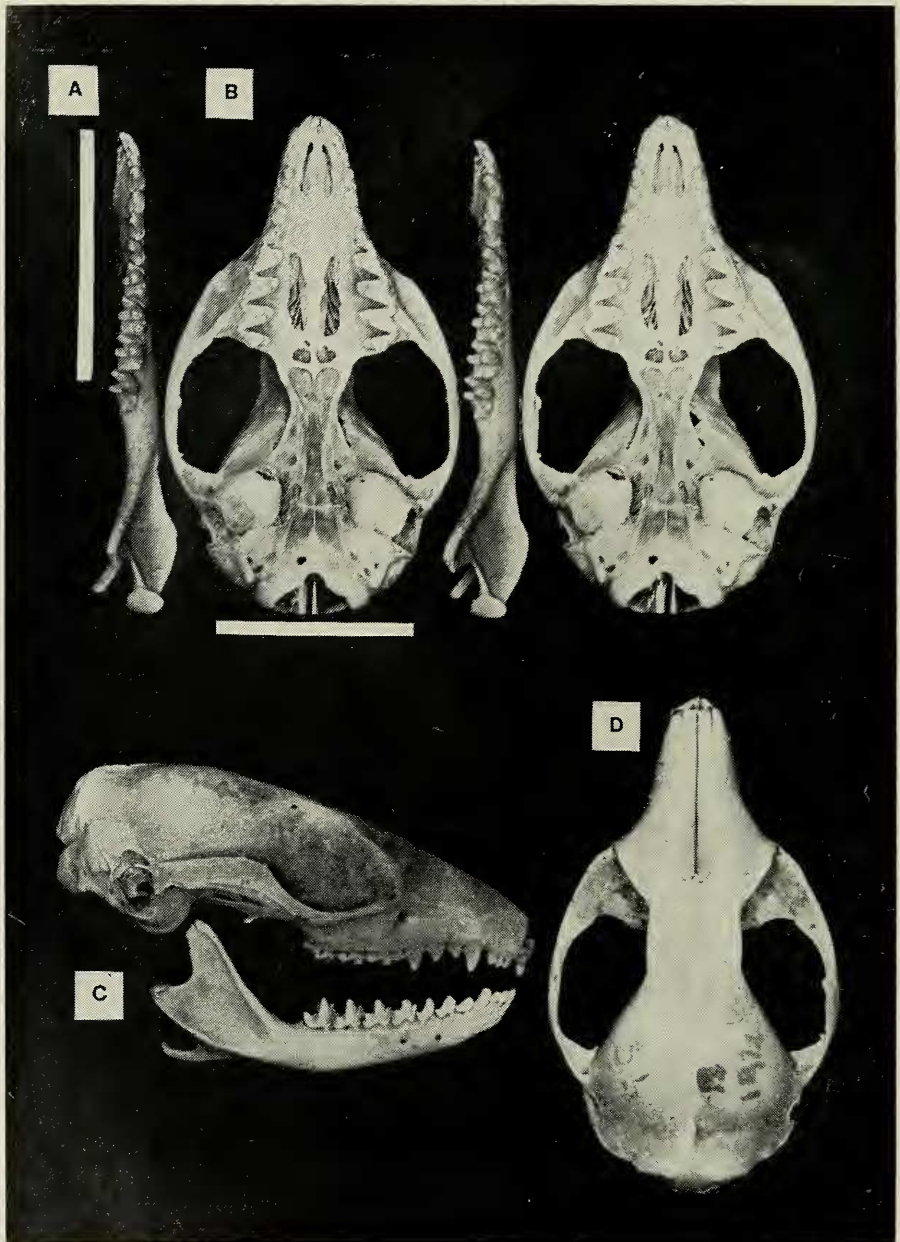


FIG. 3. A-D *Sminthopsis butleri* skull and right dentary of the holotype WAM M7158, Kalumburu, Western Australia. The white line by A represents 10 mm for A. The white line below B represents 10 mm for B-D. A and B are presented as stereopairs.

gular cusp, and is caniniform although its crown height is shorter than that of  $P^3$ . The  $P^1$  is slightly shorter in crown height than  $P^2$  and  $P^2$  is conspicuously shorter in crown height than  $P^3$ . Lingual and buccal cingula on  $P^1$  to  $P^3$  are incomplete at the base of the paraconid. Posterobuccal cingula on  $P^1$  to  $P^2$  are variably rugose with smaller irregular cusps. The  $M^1$  (e.g. B1995) is three-rooted with three principal cusps, the paracone, metacone and stylar cusp D. There is also a very reduced protocone and possibly the homologue of stylar cusp B on the anterobuccal cingulum. A complete anterior cingulum is present from the preprotocrista to the parastylar corner of the  $M^1$ . The  $M^1$  postmetacrista is large but the preparacrista is not a prominent crest. The paracones of  $M^2$  to  $M^5$  increase in height posteriorly. The protocones of  $M^2$  to  $M^4$  are subequal in height to each other, as are the metacones. The protocone of  $M^5$  is the smallest of the upper molars. Stylar cusp D is largest on  $M^2$  and decreases in size posteriorly being miniscule or absent on  $M^5$ . Stylar cusp A is indistinct on  $M^2$  to  $M^5$  but may be distinguishable on  $M^2$  (e.g. WAM M7156). Stylar cusp A is defined by the intersection of an anterior crest from stylar cusp B and the anterior molar cingulum. Stylar cusp C is not present. An anterior cingulum is incomplete except on  $M^2$  where it is sometimes complete (e.g. B1995). Rarely, an anterior cingulum is complete on  $M^3$  (e.g. B1939). The paracrista of  $M^2$  is well-formed and either extends buccally (e.g. B1995) or anterobuccally (e.g. WAM M7156) to the paracone. The preparacrista length increases posteriorly from  $M^2$  to  $M^5$ . The postmetacrista of  $M^2$  and  $M^4$  are subequal in length and shorter than the postmetacrista of  $M^3$ . The  $I_1$  is taller-crowned than  $I_2$ . The  $I_3$  has a small posterior lobe. The  $C_1$  is caniniform, subequal in crown height to  $P_3$ , has a small posterior cingular cusp, a complete lingual cingulum, and an incomplete buccal cingulum. The  $P_1$  is shorter-crowned than  $P_2$  which is shorter-crowned than  $P_3$ . Lingual and buccal cingula of  $P_1$  to  $P_2$  are small and generally incomplete. The  $P_3$  lacks a buccal cingulum but has a lingual cingulum. The  $M_1$  (e.g. B1995) is two-rooted with the protoconid as the only main cusp. There is also a small anterior cusp homologous either with the paraconid of  $M_2$  or the anterior cingular cusp of the anterior premolars, and a small posterior cusp homologous either with the hypoconulid of  $M_2$  or the posterior cingular cusp of the anterior premolars. A swelling between the posterior cusp and the protoconid may be homologous with a hypoconid. The paraconids of  $M_2$  to  $M_5$  increase in height posteriorly. The metaconids of  $M_2$  to  $M_5$  are subequal in height. The protoconids increase in height from  $M_2$  to  $M_5$ . The hypoconids of  $M_2$  to  $M_4$  are subequal in height and taller than the hypoconid of  $M_5$ . The entoconids are tiny on  $M_2$  to  $M_4$  and absent on  $M_5$ . On one specimen (B1995) a tiny metastylid appears on  $M_2$ . The paracristids of  $M_3$  to  $M_5$  are subequal in length and longer than the paracristid of  $M_2$ . The metacristids of  $M_2$  to  $M_4$  increase in length posteriorly from  $M_2$  to  $M_4$ . The metacristid of  $M_5$  is subequal to that crest in  $M_3$ . The trigonid is narrower than the talonid on  $M_2$ , subequal in width on  $M_3$ , and wider than the talonid on  $M_4$  and  $M_5$ .





A

FIG. 4. A-B *Sminthopsis butleri*, Holotype photographed alive (photographs by W.D.L. Ride).



B

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Skull and dentary (see Fig. 3 A-D): the skull is relatively brachycephalic with a short deep rostrum and broad zygomatic arches. It is domed posteriorly and, in older individuals, has well-developed sagittal and nuchal crests. A longitudinal medium depression occurs in the region of the naso-frontal suture. The interorbital region has pronounced postorbital swellings but no postorbital processes. There are normally two lacrimal foramina on each orbital rim (except on one side of WAM M2155, where there is only one). The alisphenoid tympanic wing is only slightly enlarged, leaving the ectotympanic ring broadly exposed. The periotic tympanic wing is little developed compared with other species such as *S. hirtipes*. The foramen pseudovalle is large. The transverse canal foramen is relatively large but smaller than the foramen rotundum. The opening to the eustachian canal is large, as is the internal jugular vein and the posterior lacerate foramina. The entocarotid canal is open ventrally but well-developed. The condylar foramina (including the hypoglossal foramen) is single or multiple. The premaxillary vacuity extends posteriorly usually to the level of the anterior root of P<sup>2</sup> (e.g. B1995) or the posterior root of P<sup>2</sup> (e.g. WAM M7156). Usually (e.g. B1995) several small interdental fenestrae occur between adjacent upper molars. The maxillary vacuity extends forward to the level of the anterior end of M<sup>2</sup>. The distance between the articular condyle of the dentary and the tip of the ascending ramus is slightly shorter than the distance from the articular condyle to the tip of the angular process. The masseteric fossa is large. The symphysis extends posteriorly to the level of the posterior edge of P<sub>2</sub>.

DISCUSSION: This species has been the subject of serological analysis by Kirsch (1967, as *S. nitela*, and 1977, as *S. butleri*) who also examined sera of the following species: *S. macroura* (as *S. larapinta*) from Doomadgee Mission, Queensland; *S. murina* from Busselton, and Scott River, Western Australia; *S. granulipes* from Western Australia (including a specimen from Gingin); and *S. crassicaudata* from Wongan Hills, Western Australia. He considers all of the species to be serologically differentiable at the species level. Bannister (1969) refers the Kalumburu specimens to *Sminthopsis* sp. cf. *nitela*. Ride (1970) considers the Kalumburu specimens to possibly represent *S. virginiae* (as *S. nitela*). However, the virtual absence of entoconids, rufous cheeks or comparable foot structure serve to distinguish *S. butleri* from *S. nitela*. The affinities of *S. butleri* probably lie with *S. macroura*.

The two specimens of *S. butleri* in the British Museum (BM 1939.3243 ♂ and BM 1939.3245? ♀) were collected by Mr A. S. Meek on 22 July, 1898, and were given to the British Museum as part of the Rothschild Bequest. No details of habitat or other information were recorded. The locality is given on the labels simply as "Cape York". However, Parker (1973: 121-2) has published further information about aspects of Meek's itinerary. According to letters written by Mr A.S. Meek, he indicated at least an intention to travel from Cooktown to "Thursday Island and Somerset way" for six weeks from about 22 July to 2 September 1898.



Assuming he stuck to his anticipated schedule, it seems most probable that the specimens of *S. butleri* collected by Meek on 22 July must have come from very near Cooktown.

The apparent absence of the species between the Kimberleys and Cape York (Fig. 5) is unique among dasyurids otherwise present in these two areas. I would predict the species will eventually be found (if only to have formerly occurred) in Arnhem Land. It is not at present known to occur in Cape York despite several recent surveys.

Mr W. H. Butler (p. 568 in his unpublished field notes in the Western Australian Museum Library) gives the Aboriginal name of this species as "Moonjol".



FIG. 5. Localities for *Smynthopsis butleri* (triangles) and *S. douglasi* (squares) in Australia. Queensland locality for *S. butleri* (based on Meek's specimens) is only approximate (see text).

**HABITAT AND REPRODUCTION:** Mr W. H. Butler's field notes state that he collected "... north of the King Edward River about 4 miles from the Longini landing for cargo" (Fig. 5). Specimens include one male (which I have not seen) and two females (M7158 and B1995). One was "... caught on blacksoil sandplain

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junction at bottom of airstrip . . ." and two (including B1995) were removed from ". . . flood debris at back of Mission". The blacksoil plain and sand plain were ". . . heavily vegetated with eucalypt and grass". At the time of collection there were heavy rains in the area, producing as much as 181 mm in two days. The holotype, WAM M7158 had seven pouch young (including WAM M7155-7) at the time of collection, 12 December 1965. Paratype B1995 is a juvenile that was caught on its own, 39 days after WAM M7158 was caught with the seven pouch young. The holotype and her seven juveniles were sent live to Perth where they were maintained live until 16 May, 1966, when they were used to provide sera for the studies of Kirsch (1967). For this reason, although the juveniles were collected earlier than paratype B1995, they are older in developmental age and larger in size (see Tables 1-2).

REMARKS ABOUT THE HOLOTYPE AND PARATYPE: The holotype consists of a well-preserved carcase and relatively little-damaged skull and dentaries. The paratype, B1995, a juvenile female, was collected by Mr W. H. Butler at Kalumburu, from floodwater debris, on 20 January, 1966. At the time of collection it weighed 3.9 grams. The M1 is still in situ and the M5 is erupting.

ORIGIN OF NAME: This species is named in honour of Mr W. H. Butler. Mr Butler, the well-known naturalist and conservationist, has collected many small mammals in addition to the holotype of *S. butleri*, previously unknown to science.

### *Sminthopsis douglasi* n. sp.

HOLOTYPE: Queensland Museum J5173, skull and carcase in alcohol, juvenile female, collected by Mr M. Browne, registered in the Queensland Museum on 24 July, 1931.

TYPE LOCALITY: Julia Creek (Lat. 20°40'S, Long. 141°40'E) north central Queensland, in the watershed of the Cloncurry River (Fig. 5).

DIAGNOSIS: Very large species of *Sminthopsis*, larger than all species except *S. psammophila*. Morphologically it is similar to *S. virginiae* but differs from the latter in being larger and in having a very stout or incrassated tail. It differs from most other species of *Sminthopsis* in lacking a continuous anterior cingulum on the upper molars (some *S. virginiae* also appear to lack a continuous anterior cingulum). It differs from *S. murina*, *S. ooldea* and *S. leucopus* in being larger, in having large entoconids on M<sub>2</sub> to M<sub>4</sub>, a pronounced dark stripe on the forehead, and a premaxillary vacuity that does not extend posteriorly beyond a point level with the rear of the C<sup>1</sup> alveolus. It differs from *S. granulipes* and *S. hirtipes* in being larger, in having a thinner tail, rufous cheeks, large entoconids on M<sub>2</sub> to M<sub>4</sub>, enlarged apical granules on the hairless interdigital pads, and non-granular terminal pads on the toes. It differs from *S. psammophila* in being smaller, having no crest

Table 1: Cranial and dental measurements (mm) of *Sminthopsis butleri* and *S. douglasi*

SPECIMEN	BL	ZW	OBW	IBW	C-M <sup>5</sup>	M <sup>2-5</sup>	M <sup>2-4</sup>	R-LM <sup>4</sup>	IO	IPVD	DL	I-M <sub>5</sub>	M <sub>2-5</sub>
WAM M7158 ♀	22.8	14.6	9.4	3.2	9.2	4.9	4.3	7.7	4.4	2.9	18.4	10.1	5.6
WAM M7157 ♂	21.7	13.9	9.0	3.5	8.9	5.1	4.7	7.8	4.2	2.2	17.6	10.3	6.2
WAM M7155	20.6	—	9.0	2.9	8.6	4.8	4.6	7.4	4.1	2.4	16.6	10.0	6.0
WAM M7156 ♂	21.2	—	8.6	2.8	8.8	5.3	4.7	7.3	4.5	2.2	—	—	6.2
B 1939	20.1	—	8.7	2.8	8.4	5.0	4.7	7.4	4.1	2.4	—	—	6.2
B 1995	20.7	12.6	8.7	3.1	—	—	4.5	7.3	4.4	2.6	16.3	10.5	6.1
BM 1939.3245 ♀	22.0	13.0	8.9	3.6	9.0	5.1	4.1	7.4	4.3	3.7	17.8	10.2	5.5
BM 1939.3243 ♂	—	15.3	—	—	9.8	5.2	4.5	8.3	4.5	4.4	20.5	11.2	5.7
J 5173 ♀	25.2	15.9	10.6	3.8	—	—	6.2	9.7	5.1	5.2	20.3	13.7	8.0
J 5459 ♀	26.7	16.9	10.7	4.0	11.8	6.8	5.9	9.8	5.1	5.6	22.0	13.6	7.8
AM M2172 ♂	29.8	17.6	11.3	—	13.0	7.1	6.2	10.4	5.2	—	23.5	14.9	8.2

SPECIMEN	M <sub>2-4</sub>	C-AP	C-AR	AGE	SPECIES	LOCALITY
WAM M7158 ♀	4.1	5.5	4.4	Adult	<i>S. butleri</i>	Kalumburu, W.A.
WAM M7157 ♂	4.6	5.0	4.4	Subadult	"	"
WAM M7155	4.5	5.0	4.2	"	"	"
WAM M7156 ♂	4.5	5.0	4.0	"	"	"
B 1939	4.6	5.2	3.8	Juvenile	"	"
B 1995	4.5	4.7	3.7	Adult	"	"
BM 1939.3245 ♀	4.1	4.9	3.8	"	"	Cape York, QLD
BM 1939.3243 ♂	4.3	5.9	4.9	Juvenile	<i>S. douglasi</i>	Julia Creek, QLD
J 5173 ♀	6.1	6.0	5.0	Adult	"	"
J 5459 ♀	6.0	6.3	5.6	"	"	"
AM M2172 ♂	6.1	6.7	5.6	"	"	Richmond, QLD

BL, basicranial length; ZW, maximum outside zygomatic width; OBW, distance between edges of both alisphenoid hypotympanic sinuses; IBW, distance between internal edges of alisphenoid hypotympanic sinuses; R-LM<sup>4</sup>, distance across palate from buccal sides of the left and right M<sup>4</sup>; IO, minimum interorbital width across top of skull; IPVD, distance between posterior edge of the premaxillary palatal vacuity and the anterior edge of the maxillary palatal vacuity; DL, dentary length; C-AP, distance between the dorsal surface of the articular condyle of the dentary and the tip of the angular process; C-AR, distance between the posterior edge of the condyle of the dentary and the anterior edge of the ascending ramus.

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Table 2: External measurements (mm) of *Sminthopsis butleri* and *S. douglasi*

SPECIMEN	Nose-vent (HB)	Tail-vent (TV)	Hind foot (without claws)	Ear (from notch)	AGE	SPECIES	LOCALITY
WAM M7158 ♀	88.0	90.0	16.0	17.2	Adult	<i>S. butleri</i>	Kalumburu
B 1995 ♀	69.0	72.0	16.0	15.0	Juvenile	" "	" "
WAM M7157 ♂	82.0	72.0	19.0	15.0	" "	" "	" "
WAM M7156 ♂	75.0	79.5	16.3	14.0	" "	" "	" "
J 5173 ♀	92.3	84.7	21.0	16.0	Juvenile	<i>S. douglasi</i>	Julia Creek
J 5459 ♀	—	105.0	22.2	—	Adult	" "	" "

on the tail, having rufous cheeks, large entoconids on  $M_2$  to  $M_4$ , smooth non-granular terminal pads on the toes, and a distinct mid-forehead stripe. It differs from *S. crassicaudata* in being larger, in having a thinner tail, enlarged apical granules on the interdigital pads, entoconids on  $M_2$  to  $M_4$  that are clearly not contacted by the hypocristid, a premaxillary vacuity that extends no further posteriorly than a point level with the rear of the  $C^1$  alveolus, and a P3 that is conspicuously larger than P2. It differs from *S. macroura* in being larger, in having a thinner tail, rufous colouring on the cheeks, and commonly a continuous anterior cingulum on the upper molars. It differs from *S. longicaudata* in having a tail-vent length that is less than twice the nose-vent length, non-striated to barely striated terminal pads on the digits and the apical granules of the interdigital pads, large entoconids on  $M_2$  to  $M_4$ , caniniform canines; and a premaxillary vacuity that does not extend posteriorly beyond a point level with the rear of the  $C^1$  alveolus. It differs from *S. butleri* in being larger, having large entoconids on  $M_2$  to  $M_4$ , and in having rufous cheeks.

**DESCRIPTION:** Tail: The tail is approximately equal to, or slightly longer than, the nose-vent length. Incrassation varies from being stout (paratype) to conspicuously swollen (holotype).

**Ear:** The ear is relatively large, with a markedly curled external edge on the supratragus, and with rufous hairs on the postero-internal and ventral margins of the pinna of the holotype.

**Hind foot:** The interdigital pads are fused near their bases. The apical granules are enlarged, elongate and striate. The second and fourth pads appear in the holotype to have slight ridges on the surface of the granules although this may be an artifact of alcoholic dehydration. All interdigital pads of the paratype have striate apical granules with ridges on the surfaces of these granules. The apical granule of the left third interdigital pad of the holotype is not clearly striate. There is no enlarged hallual granule in the holotype although a slightly enlarged hallual granule occurs in the paratype. Metatarsal granules are not present. Hair on the



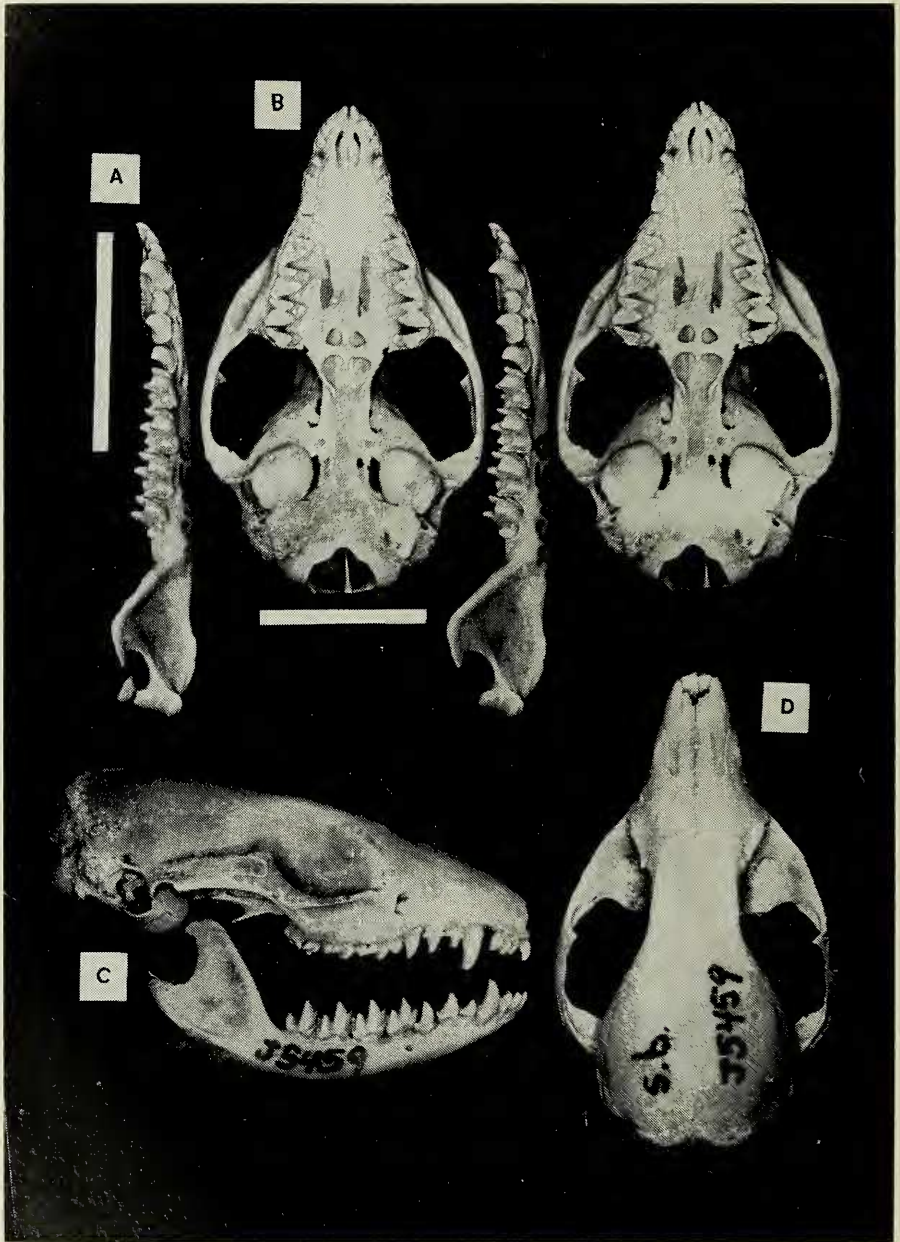


FIG. 6. *Sminthopsis douglasi*, skull and right dentary of the Holotype J5495, Julia Creek, Queensland. The white line by A represents 10 mm for A. The white line below B represents 10 mm for B-D. A and B are presented as stereopairs.



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feet covers the heel and extends diagonally across the foot. The terminal pads of the digits are not clearly striate in the holotype but suggestions of striae occur on the terminal pads of the paratype.

**Pelage:** The general colour is similar to *virginiae*, with rufous colouring on the cheeks and surrounding the eyes (except around the anterior margin). In the holotype the rufous colouring extends anteriorly just beyond the eye but in the paratype rufous colouring extends to the rhinarium. A dark brown mid-dorsal head-stripe extends in the holotype as far anteriorly as the rufous colouration. In the paratype the head-stripe extends to the rhinarium. Although both specimens are alcohol-preserved carcasses, rufous hairs appear in many areas in the postcranial pelage, e.g. behind the ears, the forearm, beneath the base of the tail, and around the ankle. Ridgway (1912) colour description for the only dry skin, referred specimen AM M2172 are as follows: head stripe, Seal Brown; above the eye, Tawny Olive; middle of the back, Bistre to Vandyke Brown; flank, Wood Brown to Ochraceous-Buff, belly, Olive-Buff.

**Nose:** The hairless rim is restricted to the extreme ventral margins of the rhinarium. The medial groove in the holotype extends to (or stops just short of) the top of the rhinarium. The nose is bicoloured, being caramel at the base to dark reddish-brown at the top. The nose of the paratype is damaged but does not conflict with this description.

**Nipple number:** The holotype has eight relatively undeveloped nipples. The paratype has seven enlarged and elongate nipples. An eighth appears to be missing from the right side.

**Dentition:** The  $I^1$  is conspicuously larger than  $I^2$  and is set off from that tooth by a diastema. The  $I^4$  is slightly larger than  $I^2$ , and a slight increase in incisor crown size occurs from  $I^2$  to  $I^4$ . Between  $I^4$  and  $C^1$  is a fossa corresponding with the crown tip of  $C_1$ . The  $C^1$  is considerably less than twice the height of  $P^3$ , and subequal to twice the height of  $P^1$ . There is an increase in premolar size from  $P^2$  to  $P^3$ . Buccal cingula on  $P^1$  to  $P^3$  are continuous, and poorly developed to absent on  $C^1$ . Lingual cingula are present on  $P^1$  to  $P^3$ , except beneath the paracone, and poor to absent on  $C^1$ . Anterior and posterior cingula and small anterior cusps are present on  $C^1$  to  $P^3$ . Small posterior cusps occur on  $P^1$  to  $P^3$ . The  $M^1$  has a large metacone, a small paracone, a basal poorly differentiated protocone, a stylar cusp D (present on the  $LM^1$  but not the  $RM^1$ ), prominent postmetacrista, no preparacrista, possibly a miniscule continuous anterior cingulum ( $RM^1$ ), and three roots. Continuous anterior cingula are absent on  $M^2$  to  $M^4$  (although the  $RM^2$  of the paratype may have a miniscule continuous anterior cingulum) and present on  $M^5$ . There are suggestions of a stylar cusp C on  $M^3$  and  $M^4$ . The abnormal nature of stylar cusp C on  $RM^2$  of the holotype and the compressed  $M^4$  of the paratype are described elsewhere (Archer 1975). The postmetacrista of  $M^4$  in the

holotype is shorter than the crown length. The  $I_1$  is the largest lower incisor. The  $I_2$  is larger than  $I_3$ . The  $I_3$  has a very small posterior cusp. The  $C_1$  is larger than  $P_3$ . Premolars increase in size from  $P_1$  to  $P_3$ . Continuous buccal cingula occur on  $P_1$  to  $P_3$ . Anterolingual cingula are absent or tiny on  $P_1$  to  $P_3$ . The buccal and lingual cingula of  $C_1$  are entire in the paratype but poorly developed in the holotype. The tip of the  $P_3$  crown of the holotype is visible beneath  $M_1$ . The  $M_1$  is two-rooted with a protoconid, a topographic homologue of the hypoconulid, and a miniscule anterior cingulum. The entoconids on  $M_2$  to  $M_4$  are large but not in contact with the hypocristids. The talonids of  $M_2$  and  $M_3$  of the paratype are wider than the trigonids, but on  $M_4$  the talonid and trigonid are subequal width as they also are on  $M_3$  of the holotype. An abnormal bifid entoconid occurs on the  $RM_4$  of the paratype (Archer 1975).

Skull and dentaries (See Fig. 6A-D): The lacrimal foramina are single or double, and occur on, or just posterior to, the edge of the orbit. The lacrimal has a variably developed posterodorsal spine. Postorbital processes are not present in the holotype or paratype. A dorsal anteroposterior depression is notable between the frontals. The skulls are mildly domed dorsally (but apparently less so than in *virginiae*). The premaxillary vacuities are short, not reaching a point level with the posterior edge of the canine alveolus. An indentation in the palate of the paratype suggests an incipient posterolateral palatal foramen. The alisphenoid and periotic tympanic wings are poorly developed and broadly expose the ectotympanic ring. The transverse foramen is small. The foramen rotundum is exposed ventrally in the paratype but is partially obscured by a ventral bony shelf in the holotype. The foramen pseudovale is large with posterolateral projections extending out from the basisphenoid portion of the alisphenoid. The entocarotid canal varies in size from short in the paratype to relatively long in the holotype. On the right side of the holotype, entocarotid canal development is such that the entocarotid foramen permits direct dorsoventral observation into the cranial cavity. The basioccipital walls of the internal jugular canal are not vertical. The masseteric fossa of the ascending ramus is broad, with the anterior border of the ascending ramus and the posterior margin of the dentary widely divergent. The angular process of the dentary is stout, short and abruptly tapered.

DISCUSSION: Troughton (1965) refers J5173 and J5459 to *S. virginiae* (as *S. lumboltzi*) without giving reasons. He does not mention the mildly incrassated tails or very large size of these specimens. He also refers another north central Australian specimen, AM M2172 from Wyangarie Station, Richmond, with a markedly incrassated tail, to *S. virginiae*. This specimen is referred here to *S. douglasi*. All three specimens are much larger than *S. virginiae* and have mildly to conspicuously incrassated tails.

*S. douglasi* appears to be most closely related to *S. virginiae*. Its large size may be a response to the presence of the sympatric and also distantly related *S. macroura*

(e.g. J7680 from Richmond and J11463 from Julia Creek). *S. douglasi* and *S. virginiae* share many cranial, dental, and external characters such as the large and morphologically similar entoconids, small alisphenoid tympanic wings, short premaxillary palatal vacuities, relatively large canines, similar foot pad structure, and caudal incrassation. If competition occurred at some time in the past it might be expected that some form of character displacement would develop, such as the much larger *S. douglasi* (developing from a structurally smaller ancestral form similar to *S. virginiae*).

**HABITAT AND REPRODUCTION:** The type locality (Fig. 5) and the Richmond area are ecologically different areas from localities inhabited by *S. virginiae*. In particular, the lower rainfall in the Julia Creek and Richmond areas (444-459 mm per year) contrasts with the higher rainfall of areas containing *S. virginiae* (1135 mm or more per year). This more arid habitat may be responsible for the evolution of incrassated tails in *S. douglasi*. Paratype J5459, registered on 24 May 1933, has 6 juveniles attached to its nipples in a well-formed pouch which is dorsoventrally about 1 cm deep. These were removed for determination of the nipple number (7). The juveniles are shrivelled through alcoholic dehydration. The lengths of the heads from the nose to the posterior edge of the occipital, range from 6.0 to 6.4 mm. Because the date of registration cannot be assumed to approximate the date of collection, it is impossible to determine at what time of year the young were born.

**MEASUREMENTS:** Measurements were recorded in the Queensland Museum catalogue for the holotype at the time of registration as (in mm): HB, 95.0; T, 97.0; HF, 21.0; E, 16.0. The tail measurement was probably made from the dorsal side and not as recommended by Thomas (1888, p. viii) from the vent. The former method is convenient for placental mammals which have a clear cut external boundary between the tail and body, but not for marsupials whose body and tail commonly have no such external boundary. Measurements of the holotype and paratype made during this study are given in Table 2. Because they are made on old alcohol-preserved carcasses whose skulls have been removed, they are only approximations of fresh measurements.

**DETAILS OF THE PARATYPE:** Paratype J5459 consists of a skull, a damaged carcass in alcohol, and 6 juveniles in the pouch, collected by M. Browne at Garomna, Julia Creek. This is possibly the same locality as that of the holotype, although Garomna is not listed in the Queensland Museum catalogue in regard to the holotype. The registration date given in the Queensland Museum catalogue for J5459 is 24 May 1933. This date may roughly correspond with the collection date, but of this there can be no certainty. An examination of Queensland Museum correspondence for 1931 and 1933 produced no information concerning the acquisition of either the holotype or paratype. Although J5459 is technically an adult, since P3 has erupted, it is a young adult with relatively unworn teeth. Both the holotype and paratype are females and may be expected to be smaller on the



average than males. AM M2172 is a male and has a larger skull, although the teeth are subequal in size.

DETAILS OF THE REFERRED SPECIMEN: AM M2172 represents a young adult male, skin and skull, from Wyangarie Station, Richmond, north Queensland. It was presented by F. L. Berney to the Australian Museum. An old label attached to the skin says "*Sminthopsis* sp. nov. allied to *virginiae*. Central Queensland". A note on the same label in E. Le G. Troughton's hand says "... original label proving that A. A. McCulloch observed distinction, in association with '*virginiae*'. E. Le G.T. 5/11/1963". The skin, even in the dehydrated state, shows a pronounced incrassated tail.

ORIGIN OF NAME: *S. douglasi* is named in honour of Mr A. M. Douglas, one of Australia's foremost naturalists and bushmen. He has spent over twenty years building up and curating collections in the Western Australian Museum and teaching many of his hard-earned skills to colleagues and students.

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